

quite a paucity of investigation into its features and effects. Most text-books on hydraulics content themselves with merely a passing reference, and make no attempt to elucidate any of the interesting and practical problems suggested by the subject. This omission Mr. Gibson has sought to make good by the publication of the results of a series of useful experiments which he has carried out in the engineering laboratories of Manchester University.

The experiments were made with the object of determining the actual rise and fall of pressure in a pipe line due to the gradual, or sudden, closing, or opening, of a valve. For this purpose a cast-iron pressure main was used, of $3\frac{3}{4}$ inches diameter, 560 feet in length, conveying water from an elevated tank, 107 feet above the laboratory floor. The results of four series of experiments are graphically represented, and these and other observations are tabulated in comparison with theoretical values obtained from a formula the construction of which is fully explained.

Mr. Gibson takes his subject-matter a step further, and includes a very useful little chapter dealing with the application of the principles established to the theory of turbine regulation. Altogether, this small volume is an exceedingly welcome recruit to the ranks of original experimental research literature in a branch of natural science which itself is of the greatest practical value to mankind.

Valve-gears for Steam Engines. By Prof. Cecil H. Peabody. Second edition, revised. Pp. vi+142. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1906.) Price 10s. 6d. net.

This book is intended to give engineering students instruction in the theory and practice of designing valve-gears for steam engines. Prof. Peabody has dealt with the subject in his usual able manner, and his methods are most lucid. The volume is divided into six chapters, with a good appendix. Graphical methods are used throughout, and the plates at the end of the book are remarkably clear.

The Stephenson link motion is dealt with in chapter iii. This gear has been so long in use that finality might be expected in locomotive practice as regards the correct lead of the valve in full gear; yet this is not the case. The late Mr. William Stroudley was a strong advocate of no lead in full gear, and he obtained remarkable results from his locomotives; others, again, follow the reverse practice.

Chapter iv. deals with the very interesting subject of radial valve-gears, of which, of course, the Walschaert is best for locomotive purposes, and is now being largely used in America in preference to the Stephenson gear, Continental practice having long adopted this course.

This is a revised second edition of the book, and the few changes that have been made have been in the right direction. We can truly recommend the work to all draughtsmen and engineers who have to deal with the interesting and intricate questions which arise when designing valve-gear.

The Bull of the Kraal and the Heavenly Maidens, a Tale of Black Children. By Dudley Kidd. Pp. xii+302. (London: A. and C. Black, 1908.) Price 6s.

MR. KIDD in his earlier works, "The Essential Kafir" and "Savage Childhood," exhibited an intimate knowledge of the social life of the Bantu race. The present book is more popular, being intended to describe a series of typical incidents in the life of a little boy. Mahleka, the "Bull of the

Kraal," is the son of the Great Wife of the tribal chief, and his heir-apparent. In sketches of this kind, the work of a sympathetic observer of a semi-savage people, there is the risk, on the one hand, of assuming that any foreigner can fathom the deeper recesses of the native mind. On the other, there is the danger of dwelling on their virtues and ignoring the darker side of the native character. Mr. Kidd seems hardly to have avoided both these pitfalls. He sometimes reads into the mind of the Bantu child ideas foreign to it, and his account of the simple life in the kraal neglects the treachery and ruthless ferocity of the Zulu, which it is never safe for the white man to forget.

With these reservations, his story of this little Zulu boy is both amusing and instructive. The careful account of the games of children will be of value for the comparative study of the subject. The folk-tales collected by Mr. Douglas Wood in south-eastern Rhodesia are, on the whole, disappointing, and contain little new incident. More valuable than these are the scraps of folk-lore which the author loses no opportunity of retailing. Particularly interesting are the illustrations of sympathetic magic. Thus, when a child's hair is cut it is buried in damp soil to make it continue growing; rain-medicine is made out of porpoise flesh, and so on.

The value of the book is much increased by the drawings of kraal life by Miss A. M. Goodall, which are artistic and well selected.

Fruit Trees and their Enemies, with a Spraying Calendar. By Spencer U. Pickering, F.R.S., and Fred. V. Theobald. Pp. 113. (London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.) Price 1s. 6d. net.

THIS little book is written for the guidance of fruit-growers, perhaps the most intelligent and enterprising of all those who live by the cultivation of the soil. Although spraying has only come into use in England during the last few years, it has been taken up with great enthusiasm; unfortunately, however, the practical man has been in many cases without adequate scientific guidance, and has been left to the mercy of the enterprising advertiser.

The various insect and fungoid pests are described, and brief notes on their life-history are given. Their effect on the fruit or tree is then stated, so that the practical man may have no difficulty in recognising with what he has to deal; finally, recipes are given for making up the appropriate wash. The instructions are clear, and the practical man should have no difficulty in following them. Some of the washes will be new to many growers; they have, however, been tested by the authors, and found to work satisfactorily. Regard is also had to the cost of the operation, as is right in dealing with problems into which financial considerations enter to a large extent. We note that the authors direct attention to the failure sometimes following on fumigation with prussic acid; the proper conditions to ensure success still remain to be discovered.

All who are interested in fruit cultivation will find this book useful.

Die Fauna Südwest-Australiens. Ergebnisse der Hamburger südwest-australischen Forschungsreise, 1905. Edited by Prof. Dr. W. Michaelsen and Dr. R. Hartmeyer. Vol. ii., sections 1-4. (Jena: Gustav Fischer, 1907-8.) Price 12 marks.

A FURTHER instalment of reports on the fauna of south-western Australia, from materials collected by the expedition dispatched from the Hamburg Museum in 1905, has been issued, and contains four

memoirs on groups of insects. The first section of this volume is by J. Weise, of Berlin, and describes the Chrysomelidæ and Coccinellidæ, of which the expedition obtained twenty-eight species, of which nine are new. The second section is by Dr. Bernhauer, and describes the Staphylinidæ, and founds eleven new species, one of which is the type of a new sub-genus. The third section, by Georg Ulmer, of Hamburg, describes the Trichoptera and Ephemeridæ, and includes a synopsis of the Trichoptera known on the Australian continent. This report is illustrated by a valuable series of drawings in the text. Five new species are described, and many larval forms. The fourth section, by F. Silvestri, describes the Thysanura, including fifteen species of Lepisma and one of Japygus. Twelve of the species are new, and one of them represents a new genus. The report is illustrated by ten plates.

The volume gives further evidence of the valuable additions to Australian zoology made by Prof. Michaelson and Dr. Hartmeyer's expedition.

Lehrbuch der Muskel- und Gelenkmechanik. By Prof. H. Strasser. I. Bd. Allgemeiner Teil. Pp. xi+212. (Berlin: Julius Springer, 1908.) Price 7 marks.

THIS book is the work of one who has made animal mechanics a life-study. Prof. Strasser will be particularly remembered on account of his work, published some twenty years ago, upon the flight of birds and the swimming of fish.

The first section of his book—some seventy-three pages—is devoted to an admirable digest of the mechanical principles involved. It is illustrated by plenty of figures.

The second part is devoted to the skeleton, the mechanical prop; the movements at the joints; the different forms of muscle, the angles which the individual fibres make when inserted into bone, and muscle work.

The third section refers to the general problem of the joints and muscles, and deals with several static problems in the first case, and with locomotion in the second.

The author has treated the whole subject much as one would treat an ordinary physical problem, in all mathematical detail. He is to be congratulated upon his method and upon the way in which he has carried it out. We believe that there is no treatise in the English language which can be considered as quite on all fours with his book, and we can heartily recommend its study.

LETTERS TO THE EDITOR.

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Diurnal and Semi diurnal Atmospheric Variations.

I HAVE read the remarks of Prof. Horace Lamb in NATURE, November 5, 1908, p. 24, and November 12, 1908, p. 47, where, although mentioning difficulties, he apparently accepts the suggestions of Kelvin, Margules, and Hann that the semi-diurnal wave of pressure can be explained by the fact that "the daily variation of temperature is not harmonic, and when analysed there is a definite component with a half-day period," and "on a rotating earth the period of free oscillation of the atmosphere lies very near to twelve hours."

In connection with this, I wish to direct attention to the

fact that an analysis of the records of instruments carried by kites shows that the chief oscillation in temperature in the body of the atmosphere is a semi-diurnal one, and not a single oscillation such as is found near the ground.

In a discussion of the observations obtained with kites at the Blue Hill Meteorological Observatory, published in the annals of the Astronomical Observatory of Harvard College, vol. lviii., part i., 1904, I showed that the single diurnal oscillation of temperature nearly disappears within 300 metres of the earth's surface, and from 500 metres to 1500 metres only a semi-diurnal oscillation is distinctly apparent.

For the method employed the reader must be referred to the publication mentioned. The final results in degrees Fahrenheit were as follows:—

Normal Diurnal Temperatures at different Levels above Blue Hill.

Height in metres	A.M.						P.M.						Mean
	I	3	5	7	9	11	I	3	5	7	9	11	
15	39.9	37.9	37.7	39.4	47.9	51.8	53.8	53.9	51.5	47.2	42.8	41.2	45.4
500	45.7	46.0	45.6	44.6	43.5	44.1	45.8	45.8	44.2	43.2	43.6	44.6	44.7
1000	40.4	40.4	40.5	40.4	39.8	40.1	40.5	40.4	40.3	40.3	40.0	40.2	
1500	37.5	36.9	36.5	36.8	36.0	34.5	35.2	36.4	36.1	34.7	34.9	36.9	36.0

The harmonic values computed from the observations are as follows, the epoch in each case being midnight:—

Height	Harmonic values
15 m. ...	$45.4 + 8.33 \sin(234 + x) + 1.63 \sin(73 + 2x) + \&c.$
500 m. ...	$44.7 + 0.47 \sin(13 + x) + 1.07 \sin(18 + 2x) + \&c.$
1000 m. ...	$40.2 + 0.09 \sin(85 + x) + 0.35 \sin(344 + 2x) + \&c.$
1500 m. ...	$36.0 + 0.09 \sin(47 + x) + 0.80 \sin(0 + 2x) + \&c.$

These results show that the amplitude of the single diurnal period near the earth's surface (15 metres above sea-level) is 8.3 F., but at 500 metres it has decreased to less than half a degree Fahrenheit, and at 1000 metres to less than a tenth of a degree Fahrenheit. At 1500 metres the range apparently increases somewhat, but this is perhaps owing to the small amount of data available at that height. The mean of all the daily ranges between 500 metres and 1500 metres, inclusive, is slightly less than half a degree. Furthermore, at 500 metres to 1500 metres the phase angle has changed nearly 180° as compared to that at the earth's surface, so that the maximum in the daily wave of temperature comes at night instead of during the day. The reversal of phase apparently takes place between 300 metres and 500 metres.

Turning to the values in the formula showing the semi-diurnal period, it is seen that at 500 metres and 1000 metres the amplitude is nearly four times as great as is the amplitude of the diurnal period, but at 1500 metres the two appear to be nearly equal. The maxima in temperature are about 3 a.m. and 3 p.m., not far in time from the semi-diurnal minima of pressure, while the minima of temperature are near 9 a.m. and 9 p.m., not far from the times of the semi-diurnal maxima of pressure.

In commenting on these results in the publication referred to, I say (p. 32):—"But the fact of particular interest is that the mean of the amplitudes of the semi-diurnal period from 500 to 1500 metres, thus including the larger portion of the lower atmosphere, is greater than the mean amplitude of the diurnal period. This fact is of interest in connection with the views of Lord Kelvin, Dr. Margules, and Dr. Hann concerning the cause of the semi-diurnal wave."

In 1905 Prof. Frank H. Bigelow, analysing the data obtained at Blue Hill more in detail and by a method somewhat different from my own, confirmed the existence of the semi-diurnal period of temperature in the body of the atmosphere. He says:—"The single diurnal period at the surface is replaced by a double diurnal wave at 400 metres, and this appears quite plainly in every month except July, where it is probably nearly extinct" (*Monthly Weather Review*, 1905, p. 55).

The existence of a maximum of temperature by day and a secondary maximum at night, with a diurnal amplitude of about 1.3 C. at a height of 1200 metres above Hald, Denmark, has also been disclosed by W. Wundt in an analysis of the observations made with kites at that station (*Meteorologische Zeitschrift*, 1908, pp. 337-41).